

THE EFFECT OF PERSONAL LEARNING NETWORK EXPOSURE ON PRE-SERVICE TEACHER'S DIGITAL RESOURCE SEARCH HABITS

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ABSTRACT

Teacher confidence with technology integration remains generally low over time, and teacher preparation programs have been tasked with supplying the education sector with teachers ready to implement an ever-changing toolkit of technologies. These efforts can be hampered by isolation of the traditional technology course and lack of field component. In this pilot study, the authors leverage students' personal experiences gained while creating a self-developed Personal Learning Network (PLN) to build confidence and capabilities for searching appropriate web-based resources to include in a technology-infused lesson plan. Through two course iterations, framing PLN construction around internet searches of their final project resources was found to increase PLN and resource portal utilization, a course goal to improve the quality of selected resources over those found in more simplistic internet searches. Further iterations look to increase connections between assignments exploring technologies and integration into student-created lessons.

Keywords: Personal Learning Network, Technology Integration, Pre-service Teacher, Experiential Learning, Social Media, Teacher Beliefs, Teacher Confidence.

INTRODUCTION

An increased emphasis on K-12 classrooms' innovative technology usage to equip students with necessary skills and knowledge for the competitive global economy (Dede, 2011; ESSA, 2015; Frank, Zhao, & Borman, 2004) has highlighted a need for fundamental changes to pedagogical practices used in teacher preparation programs. The International Society for Technology in Education (ISTE) describes standards for teacher preparation programs to follow (ISTE, 2017), and the new Council for Accreditation of Teacher Preparation (CAEP) accreditation standards include technology as a cross-cutting theme (CAEP, 2016). In these documents calling for pedagogical changes to be implemented in k-12 classrooms, a lack of defined best practices to prepare teachers with needed experiences for effective incorporation of new and unknown technologies into teaching practice is also described. Innovative

technologies in future k-12 classrooms throughout all subject areas differ from how many American higher educational institutions approach preparing future teachers through the requirement of a stand-alone 3-credit educational technology course completed prior to or during the student teaching component (Sandholtz & Reilly, 2004; Crawford, Martin, & Tanguma, 2002). Although students experience some technology integration in other content areas, these courses are designed to provide a foundation for purposeful use of constantly changing hardware, software, and web applications while incorporating the latest in learning and media theory.

Despite inclusion of educational technology courses in teacher preparation programs, as well as numerous professional development support efforts for in-service teachers, almost half of classroom teachers still feel underprepared to implement desired technology innovations (Buckenmeyer, 2010; Ertmer, Ottenbreit-

Leftwich, Sadik, Sendurur, & Sendurur, 2012; Kay, 2007; NCES, 2009; Moser, 2007). Time was often cited as a major barrier, yet adding more time (i.e., courses) during teacher preparation or early career stages is not a viable option. Further complicating matters is a common lack of field-based components in educational technology courses. This lack is exacerbated by little consistency in technology efficacy of supervising teachers or field coordinators as well as available technologies in existing field components.

One fundamental aspect of technology integration is the ability to find appropriate resources on the internet (Durak, 2018). While teachers can easily find resources through a Google search, it says little about the quality of the resources. Further, while certain clearing houses have their resources linked to standards and vetted by professionals for quality, other sites, such as Pinterest and Teachers Pay Teachers, lack quality oversight and often rely on user ratings as an indicator of quality. A Personal Learning Network, or PLN, consisting of content area experts prolific on social media networks may provide easily accessible resources with approval of an expert in the field.

This paper outlines results from piloted changes to strategies used for a social media networking assignment made as one facet of a larger, evidence-based educational technology course redesign within existing time and course content parameters. In this paper, the authors outline the daunting challenge of preparing pre-service teachers for future use of constantly changing technologies and review current literature in the field to provide the rationale for course changes. A description of changes made within the pre-existing technology course are provided. Finally, data collected about the impact on students' values and beliefs related to their future teaching through technology will be used to make recommendations for future directions.

1. Literature Review

The review of literature on this topic begins with research on attitudes toward teaching with technology, the primary focus of this study. A focus on research regarding the influence of learning experiences on teaching follows. Finally, the scope is narrowed down to research regarding learning and social media use.

1.1 Importance of Attitudes, Beliefs, and Values for Teaching through Technology

Extending research from in-service teachers (ISTs), much of the research on pre-service teachers (PSTs) and their technology use is focused on developing technological skills, confidence, and beliefs related to their future use of technology. Ertmer (1999) originally categorized barriers to technology integration as reported by teachers in a series of school-based studies into two categories: first-order (extrinsic) and second-order (intrinsic). Her findings indicated the second-order barriers were as important than first-order barriers as predictors of successful technology integration. Ertmer, Ottenbreit-Leftwich, and York's (2006) study anonymously surveying 25 exemplary technology-using teachers confirmed the continued importance of beliefs and attitudes in technology integration. In 2012, Ertmer et al., used a multiple case study approach with 12 exemplary (i.e., award-winning) technology-using teachers with similar findings emphasizing the importance of beliefs and attitudes. Finally, the role of pedagogical beliefs can play a role in technology adoption. Burke, Schuck, Aubusson, Kearney, and Frischknecht (2017), in their survey of over 150 Australian teachers saw a strong correlation between technology adoption and a constructivist-oriented (versus transmission-oriented) mindset. This idea is also reflected in the work of Ertmer et al. (2012).

A study surveying 144 suburban high school teachers participating in a professional development on educational technology found that three of the factors originally described in Ertmer's earlier work explained 25-40% of the change in teacher adoption of technology when combined (Buckenmeyer, 2010). When analyzed separately, the data showed that teachers' attitude towards technology was the strongest predictor. Another study seeking to evaluate the impact of the funding provided by the Preparing Tomorrow's Teachers to Teach with Technology (PT3) on teacher integration of technology used document analysis of 51 project evaluation reports, peer-reviewed journal articles, and conference papers (Polly, Mims, Shepherd, & Inan, 2010). Their findings showed that even when technological skills were acquired by PSTs in grant funded endeavors, this did not translate to their ability

to successfully integrate technology in classrooms as ISTs.

Other studies focused on PSTs seemed to indicate a similar importance of attitude and beliefs as an indicator of later technology integration. One study comparing 145 Chinese PSTs and 145 American PSTs used multiple surveys designed to assess teacher preparation for later classroom integration of technology (Guoli et al., 2007). Even after completion of an educational technology teacher preparation course, the majority of PSTs from both countries did not feel confident about their abilities to later teach through technology. This lack of confidence about future ability was also true within the subpopulation of high achieving students in the educational technology course.

Interestingly, even using technology for personal use for an average of 2.5 hours per day did not correlate with higher technology use in the classroom (Lei, 2009). Lei's findings from a survey of 51 PSTs at a large northeastern university showed the digital-native PSTs (i.e., PSTs belonging to the millennial generation who were born after 1980) reported strongly positive beliefs about the overall power of technology to help them teach. At the same time, they reported only moderate confidence and interest in using technology in their future classrooms. This is consistent with what was observed in previous comments and student assessments in our educational technology course. In contrast to Lei's study looking at the effects of informal technology experiences on future teaching intentions, Morrison and Jeffs (2005) studied the outcomes of using a specific technology for learning within a pre-service course on beliefs and confidence for using this technology in the future. Using a mixed methods approach with a convenience sample of 37 special education majors enrolled in a required reading and writing methods course, they found students with positive experiences learning through the AlphaSmart 3000 (i.e., a device similar to a rugged tablet) reported positive attitudes and beliefs about using it in the future. In summary, there is a confirmation of the importance of confidence as a predictor of technology integration, but general technology acumen does not guarantee confidence. Thus, specific experiences with educational technologies may be key to increasing confidence.

1.2 Importance of Experience to New Learning through Technology

Currently the expectation is for PSTs to teach through technology, using "new technologies to qualitatively and sometimes quite profoundly reshape activity systems rather than just augmenting them" (Salomon & Perkins, 2005, p. 79). To clarify expectations with an example, the ability for an American teacher and a British teacher to conduct a live time connected classroom discussion on the Revolutionary War via web conferencing uses the same historical information as available in the past, but the changes to the activity itself possible from technology creates a far richer learning environment. Even in the decade since that writing, innovations such as Geographic Information System (GIS) data availability increases transformative possibilities for teaching and learning. Multiple studies have shown intrinsic characteristics such as attitudes and beliefs are of similar or more importance to teachers' effective integration of technology than the more structural and institutional factors such as access to computers and internet availability (Eifler, Greene, & Carroll, 2001; Ertmer & Ottenbreit-Leftwich, 2010; Ertmer et al., 2012; Kay, 2007; Moser, 2007). In what types of experiences can these factors be addressed when technological possibilities continue to change? Researchers found many pre- and in-service teachers lacked personal experience with integrated technology in classrooms, resulting in a limited ability to build their own visions of technology integration to implement (Alexander, Knezek, Christensen, Tyler-Wood, & Bull, 2014). This results in a continued pattern of limited levels of integration. In an essay reflecting on how technology has and has not changed the way we teach and learn over the last twenty years in American teacher preparatory programs, Percy (2013) observed that despite available technological possibilities for change, PSTs emulate their predecessors, not what they have learned.

As adults, practical learning is the starting point (Hargreaves & Fullan, 2000; Kenner & Weinerman, 2011; Knowles, 1977). A historical analysis of mentoring needs and programs by Hargreaves and Fullan found that mentoring

needs have changed since the 1960s due to the type of teaching needed for what they describe as the Fourth Professional Age we are in now. Given new methods of teaching needed involving communities and others as integral supports to teaching, they outline strategies for using early teacher experiences as ways to effect teaching practice changes. Simultaneously, their analysis also showed very few current systems exist for mentoring early teachers in innovative approaches. This speaks to the need for educational technology faculty to provide PSTs with rich experiences to build on later as they may not otherwise get them when they enter the classroom.

Early efforts by Darling-Hammond & Sykes (1999) to create a guide on effective teaching for future pre-service and early career mentors emphasized benefits of personal experience with learning and using different pedagogical strategies as formative to PST development. The continued inclusion of experience as key to effective student teaching is based on Darling-Hammond's decades of experience researching the relationship between teaching, standards, assessment practices, and student achievement using large-scale data analysis. Extensive qualitative research efforts exist that richly describe intrinsic teacher changes from adult learning theory and teacher professional development design for transformative learning (Darling-Hammond, Wei, Andree, Richardson, & Orphanos, 2009; Dirkx, 2006; Storant, Dossin, & Lacher, 2012; Taylor, Dirkx, & Pratt, 2001).

This research supporting personal experiences as essential to learning and changing belief systems as well as the research demonstrating the importance of beliefs and values to technology integration provided a pathway guiding the piloted changes the researchers made in the current course iteration. Teachers who experienced learning in a transformative environment had a better understanding of concepts needed to design transformative learning environments (Martin, Strother, Beglau, Bates, Reitzes, & Culp, 2010; Strudler & Hearnington, 2008). Applying this logic to frame our own anecdotal course evidence and informal reviews of previous course artifacts, our assignments utilizing a Personal Learning Network became a focal point for our inquiry.

1.3 Importance of Learning and Teaching through a Professional Learning Network (PLN)

In the previous iteration of the course, attention focused on ensuring that students had experiences constructing different types of digital artifacts to demonstrate their ability to use the ISTE Standards for Students (ISTE, 2017), or ISTE-S. Each artifact was designed around authentic teacher tasks with opportunities for collaboration, feedback, coaching, and reflection; all considered to be successful strategies for teaching technology integration (Goos, 2005; Koehler & Mishra, 2005; Koehler, Mishra, & Yahya, 2007; Martin et al., 2010; Mishra & Koehler, 2006; 2009; Mishra, Koehler, & Kereluik, 2009; Olofson et al., 2016; Polly et al., 2010). The resulting artifacts did not demonstrate students perceived their experiences with possibilities from new technologies such as using Social Networking Services (SNS) as directly connected with their experiences in the field. For example, student lesson plans were more often uses of technology for traditional activities such as using computers to create posters about the Revolutionary War rather than taking advantage of the connectedness and communication possibilities afforded by SNS such as Twitter. The unit on Personal Learning Network (PLN) creation was intentionally designed to ensure students would leave their teacher certification program with the knowledge and ability for accessing the needed type of ongoing professional development and connections for continued technology integration growth, yet student artifacts reflected a general lack of interest consistent with Lei's 2009 study as well as a four year, cross-sectional study of 206 PSTs by Hughes, Ko, Lim, and Liu (2015).

As experienced teachers and educational technology faculty members, both researchers strongly believe in the importance of a PLN for professional use in teaching (O'Bannon, Beard & Britt, 2013; Schiebel, 2010; Williams, Foulger, & Wetzel, 2009). Use of SNS, such as Twitter, Pinterest, and Facebook as professional tools such as required in the course PLN creation is positively associated with teacher's enacted technology integration as well as increased content knowledge in practice. Social media use benefits also extend beyond its integration into teaching and learning. This highlights social media's ability

to enhance student's sense of community, through fostering celebration of accomplishments, connections to other scholars, along with dialogue, networking and collaboration between disciplines (Manago, Taylor, & Greenfield, 2012). Findings from this survey of 400 undergraduate's use of Facebook contributed to the design of a multi-year, mixed methods research effort of using SNS to support graduate level programs with similar results encouraging SNS use in the future (Rosenberg, Terry, Bell, Hiltz, & Russo, 2016). These experiences in university coursework contribute to their identity as teachers from which they will later make instructional and curricular decisions (Hughes et al., 2015).

To summarize, research has shown confidence with technology integration as a key indicator to future use of technology for learning. PSTs would appear to benefit from learning experiences with new technologies. One newer application of educational technology for lifelong learning is through a Personal Learning Network. However, despite importance given to creation and/or use of a PLN by PSTs in research, PLN anecdotal student feedback and observed use of the PLN in their other artifacts showed students did not feel the same. Thus, the study detailed ahead focuses on refining one such activity in our educational technology course for PSTs, attempting to make the experience more meaningful to the students.

2. Methods

The purpose of this study was to answer the following research question: Does requiring students to utilize a specific technology for their own learning influence the probability of them utilizing that technology when designing a technology infused lesson plan within an educational technology class? The authors chose the PLN unit to apply an intervention giving students specific experiences designed for learning through PLN technologies to see if it positively impacted their later teaching through the PLN technologies.

2.1 Setting

The pilot study took place in a pre-service technology integration course at a regional comprehensive liberal arts university. The course is offered in a hybrid format during the academic year (i.e., several face-to-face meetings with

the majority of the content and instruction conducted through a learning management system); however, during the spring and summer semesters, the course has one face-to-face meeting at the beginning of the six-week course. Thirteen students were enrolled in one section of the spring semester course and fifteen students were enrolled in one section of the summer semester course. There was a mix of elementary and secondary majors, as well as two special education majors.

The course, titled Technology in Education, covered a variety of topics in educational technology, such as cultural issues, the digital divide, media integration, assessment and evaluation with technology, and online learning. The major course assessment is a technology-based lesson plan that follows the ASSURE model (Smaldino, Lowther, & Russell, 2012). In addition to the lesson plan, there were several online discussion assignments as well as reflection papers on each of the topics in the course. While the university uses BlackBoard as its LMS, this course has consistently relied on other platforms that K-12 educators are more likely to see in the field. During the two consecutive semesters, the course content was housed using Google Apps for Education (GAPE) and Google Classroom.

The current course design includes a series of technology-based projects incorporating classroom applications along with educational technology-specific content, such as creating a WebQuest for classroom digital literacy. In a prior course design change, the course content was aligned with the P4 framework (Professionalism, Productivity, Preference, & Pedagogy) to afford students a holistic view of how educational technology is used not only in the pedagogical aspects of teaching, but for many other areas within teacher practice essential for ongoing personal development (Siko, 2017). Course assessment data indicated that students were able to successfully demonstrate in their written and digital artifacts the skills needed to design digital learning environments and assessments such as called for in the International Society for Technology in Education - Teacher (ISTE-T) standards (ISTE, 2017). However, data indicated that while students were able to successfully complete this project, course

evaluation data showed they did not value certain assignments. In particular, students were generally ambivalent to defiant about social media as a useful tool in their practice (Amalfitano, 2017).

Based on this, the course unit on Professionalism was selected as a focus. During this unit, students were tasked with creating a Personal Learning Network (PLN) beginning with a personal blog. During the unit students self-selected resources on educational organizations and educators available via social media, documenting their finds with screenshots, and short reviews on their PLN blog. The teaching impetus for this unit stemmed from a belief that successful ongoing professional growth and support for quality technology integration is often through interacting informally with other educators on the web and social media resources (Siko, 2017). Reviewing the content, assessment, and pedagogical structure of this unit, a decision was made to change the timing of some tasks in order to apply adult learning theory premises. In the original assignment, students front-loaded their blog with resources from social media sites, but students were not required to return to these same sites to use them as resources for future assignments. The updated assignment by the instructors provided students with mentored experiences learning through their PLN to ensure students acquire first-hand knowledge of how valuable it could be in later practice (Adamy & Boulmetis, 2006; Kolb, 1984; Salomon & Perkins, 2005; Vygotsky, 1978).

For this pilot, the resource submission timing to integrate with other units of simulated typical teacher tasks was changed. For example, in a later unit where students researched and created materials for accommodating diverse student needs, students are now required to include web and/or social media resources found through using their PLN. Data collected from a summer implementation of this pedagogical change within existing course content will inform other areas for restructure following this method of first providing specific student personal learning experiences for tasks through various technologies, then requiring use of those technologies for later teaching tasks.

2.2 Procedure

To ensure students were able to experience benefits of

specific instructional tools first hand as a source of professional resources and supports, two assignments were altered. As described earlier, anecdotes from course evaluations in previous semesters indicated ambivalence and dissatisfaction with assignments related to creating a Personal Learning Network (PLN). Previously, students were asked to create a PLN by researching state and national organizations, social media services (e.g., Twitter, Facebook, Pinterest, YouTube channels), and educational bloggers. Their assignment included listing and annotating their findings, including screen captures to prove that they added these resources to their social media streams (e.g., a screenshot of their Twitter feed and a screenshot of their RSS reader). For the rest of the semester, students were encouraged but not required to refer to their PLN when searching for final project ideas and resources.

Keeping the same content and purpose of the PLN creation for ongoing course use as described, an additional blog entry assignment was added for this pilot as a part of a different unit to ensure students incorporated their own PLN directly as a resource. In this new entry, students were asked to describe three potential resources they found to use in their final project. One of the resources needed to be from a teacher-provided list of resource portals (e.g., clearinghouses of lessons and media tied to curricular standards, such as Discovery Education, NCTM Illuminations, and PBS Learning Media). One resource needed to be from their PLN, and the final resource could be found from an internet search.

Another area of concern was related to PSTs having available resources about diverse student needs, yet showing limited attention to these diverse needs in their final lesson plan. While students conducted a learner analysis as one of their early assignments, many students' submissions did not acknowledge student diversity outside of race. That is, they often failed to acknowledge the presence of English Language Learners (ELL), students with learning disabilities, students with physical impairments, and students coming from low-income households. Even for those who did acknowledge their existence, few included accommodations or modifications in their final lesson plan. Those that did often listed accommodations

too general in nature (e.g., give students more time if they need it, let them come in early or stay after school if they did not have access to technology at home).

Thus, an additional assignment was added where students researched a tool to address one or more principles of Universal Design for Learning. First, the students were asked to review examples of technologies using the Center for Applied Special Technology (CAST) website (<http://www.cast.org>). Second, to ensure students experienced the technological tools available for themselves as one of their future students might experience it, they created a screencast describing how a particular tool could achieve the UDL components they were assigned.

2.3 Data Collection and Analysis

The summative assessment for the course, the technology-infused lesson plans, were reviewed by the authors to see if their selected resources for the two assignments (the blog post on finding resources and the screencast review of a tool to support UDL). If a resource that was listed in blog post was used in the final assignment, its source was noted. That is, since students were asked to find resources from different areas, did the resource come from a Google Search, their PLN, or through a resource portal? Finally, where available, student comments on course evaluations were analyzed for specific mentions of the assignments being examined.

3. Results

During the spring semester, all 13 students completed both the PLN and UDL assignments as well as the final lesson plan. The results are summarized in Table 1. The majority of students used at least one resource from their blog assignment in their final project; however, most of the students did not use their UDL tool as a means of removing barriers to learning.

In looking at the sources of the total number of resources used, they were equally split between the three possibilities, as summarized in Table 2.

When student comments in the course evaluations were examined, they were found to be mostly positive. While 12 of the 13 students completed the course evaluations, only eight provided additional comments. When asked about elements of the course that were helpful, they were mostly

	N
Students using 0 resources from resource finding assignment	3 (23%)
Students using 1 resource from resource finding assignment	6 (46%)
Students using 2 resources from resource finding assignment	4 (31%)
Students using 3 resources from resource finding assignment	0
	N
Students using resource from UDL assignment	4 (31%)

Table 1. Usage of Resources Submitted for Course Assignments in Final Project during Spring Semester (Total N=13)

	N
Google	4 (28%)
PLN	5 (36%)
Resource Portal	5 (36%)

Table 2. Sources of Resources used in Final Project during Spring Semester (Total N=14)

general in nature. However, one student did state that the PLN unit was the most helpful aspect. There were no negative comments about the content of any assignments, which was a strong deviation from previous semesters' feedback.

For the summer semester, the procedures were altered slightly. Students were given design scenarios that provided some flexibility, opportunities, and challenges to address. Since the course is not a field-based course, in previous semesters any classroom setting or learner analysis was largely hypothetical and based on a past, present, or future placement of the student. In the summer semester, students were given three scenarios to choose from: a rural, urban, or suburban district. Demographic data, test scores, and similar data were provided for each of these scenarios. These data were actual data from districts within the state, with district identifiers removed. This data was to be the basis for their learner analysis assignment. Further, on the first day of class, they were given two poker cards, of which they were allowed to "play" one of the cards as an addition to their scenario. The number of the card represented available technology (e.g., 1:1 tablets, a bring-your-own-device setting, or an interactive whiteboard and a cart of tablets or laptops), while the suit represented a diverse population they needed to address in both their UDL and final project assignment (e.g., multiple ELL students, students classified on the autism spectrum, students with physical impairments, or a high number of students

classified with a learning disability). It was thought by providing more scaffolding (with both challenges and opportunities), students would be more thoughtful in searching for lesson resources as well as finding technologies to support UDL.

For the summer semester course, there was unusually high course attrition; of the fifteen students originally enrolled in the course, four did not complete the course. Of the eight remaining students, usage of resources is summarized in Table 3.

With respect to the sources from which students found their resources, the distribution is no longer equal. While Google and resource portals are roughly equal, the students' PLN was not as highly utilized (Table 4).

In summary, there are slightly different usage rates between the two semesters. On one hand, overall usage of the students self-created Personal Learning Network went down due to changes in the structure of the course. On the other hand, utilization of resources to meet needs of diverse learners increased. No single source (i.e., Google, PLN, or resource portal) seemed to stand out as a "go-to" source for finding media or technology resources for their final projects.

4. Discussion

Due to nature of a pilot study, it is difficult to draw strong conclusions. In previous course iterations, students had a negative view of PLNs and associated activities in the technology integration course. In the spring semester of the

pilot, no negative feedback on course evaluations regarding the assignment was observed. Further, there was clear evidence that students were using resources from their PLN in their final project. Students equally utilized resources found through resource portals and traditional Google searches. Regarding confidence in using technology, one could posit students would be most familiar with internet searches; given the age of these students (i.e., generally in their early to mid-20s), they spent almost their entire P-16 career with internet (and thus, search engines) available to them. In line with Pearcy's (2013) observations and research by Alexander et al. (2014) and Ertmer et al. (2012), these teachers were comfortable using Google because they essentially grew up using it.

Thus, any use of the PLN (and prescribed resource portals) could be considered a gain toward increasing use of new technologies and reducing reliance on older ways of finding resources. This is an indication that students, with proper instruction, can be more selective in their choices when it comes to integrating digital resources in their instruction. While many would assume that these supposed "digital natives" would inherently know how to conduct targeted internet searches, these results begin to support a contrarian notion that despite their near immersion in technology from birth, they still need some scaffolding.

Comparing the two different sets of data, it was observed in the second course iteration the direct PLN use decreased but use of the UDL resources emphasized in class increased with the new course changes. This resulted in almost identical usage of resources presented in class overall (1.4/student in the spring and 1.3 in the summer), supporting the idea of learning through technology being superior to simply providing students a one-off exercise and referencing online course materials. In the next course iteration, these assignments were fine-tuned and data collected from the fall cohort to see if the results are replicable on a larger scale (Amalfitano, 2017). Having students personally experience benefits from these technologies align with the work of Darling-Hammond and others (Dirkx, 2006; Storant, Dossin, & Lacher, 2012; Taylor, Dirkx, & Pratt, 2001). Continued use of the PLN in their

	N
Students using 0 resources from resource finding assignment	5 (46%)
Students using 1 resource from resource finding assignment	4 (36%)
Students using 2 resources from resource finding assignment	2 (18%)
Students using 3 resources from resource finding assignment	0
	N
Students using resource from UDL assignment	6 (55%)

Table 3. Usage of Resources Submitted for Course Assignments in Final Project during Summer Semester (Total N=11)

	N
Google	3 (38%)
PLN	1 (13%)
Resource Portal	4 (50%)

Table 4. Sources of Resources used in Final Project during Summer Semester (Total N=8)

professional career would be a worthy line of research to see if the experiential use of a PLN has lasting effects beyond their preparation.

Conclusions

In this study, slight pedagogical changes within existing time and course constraints to pre-service teachers' technology exposure and resulting effects on their attitudes and utilization of such technologies was examined. Perceptions regarding one aspect of a technology course, development of a PLN to filter relevant and quality educational resources, were more positive than previous course iterations. In addition, utilization rates of the PLN to build lessons were on par with what authors perceived as the previously more common and lower quality method for finding resources (i.e., internet searches). Given the need for teachers to continuously access, evaluate, and implement web resources using new technologies in the future, using a PLN may become an effective support tool for teachers in ways that relying on frequent Google searches are not capable of matching. As this was a pilot study, generalizations would be suspect at this time. However, results are encouraging, and future changes to assignments in technology integration courses utilizing web-based tools and technologies in a more meaningful manner are recommended for further exploration.

As well, pre-service teachers' feedback about their attitudes and beliefs about technologies presented is critical to include as an essential part of educational technology instructor's common practice. As research has stressed the importance of beliefs and confidence on promoting quality technology integration (Buckenmeyer, 2010; Ertmer & Ottenbreit-Leftwich, 2010; Ertmer et al., 2006; Polly et al., 2010), formatively assessing these beliefs on a case-by-case basis can act as a bellwether to determine whether a change in the instruction is necessary. A related study inclusive of attitudes, confidence, and future intent to use in teaching surveys was designed with this purpose in mind to use with this larger fall cohort of students, approximately 150 PSTs (Amalfitano, 2017).

As previously mentioned, further lines of inquiry could include more longitudinal studies examining persistence of pre-service teachers' pedagogical practices

incorporating technology in their future teaching at various intervals selected to span changes in specific technology tools available. Further changes to the technology integration course at this institution are also in development for study as a result of this pilot. Finally, better mechanisms to ensure pre-service teachers' use of technology across all subject areas during their placements consistent with current technology standards, with field coordinators and cooperating teachers highly skilled in technology integration can also act as conduits for further confidence building and increasing effective technology integration abilities.

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